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GPS Jamming at the Etcheron Valley Range

GPS ARENA DATA SHARED WITH IBAR'S NAVLAB

Jamming—*Poles for the jammer emitters loom over a test item at the Etcheron Valley Range GPS Antenna Arena.*

If a Hollywood set designer combined a Druid temple with a carnival ride, it might look like this. Eight wooden telephone poles are arrayed in a giant circle. Bolted to each pole, facing inward, is a metal rail on which an antenna horn slides up and down. At the center of the circle is a massive, motorized test stand with a 16-foot-long polished aluminum platform slowly rotating on top.

This is the Global Positioning System (GPS) Antenna Arena, part of the Etcheron Valley Range, the nation's only full-spectrum outdoor GPS jamming/anti-jamming range. The Arena is a joint effort of the GPS/INS Branch and the Etcheron Valley Range.

Mounted on the rotating platform is today's test item—an Air Force GPS antenna—which is being jammed with signals from the antenna horns.

The Growth of GPS

That GPS jamming should become an issue for the Navy was inevitable. In the past 10 years, the world's public and private sectors have become dependent on satellite-based navigation. The U.S.-owned network of GPS satellites in geosynchronous orbit provides accurate position information anywhere in the world.

To the military, GPS is a primary guidance and location system for ships, aircraft, tanks, trucks, and weapons. In fact GPS is Congressionally mandated for all new weapon systems, with even foot soldiers on the battlefield relying on GPS to guide their maneuvers. Civilian applications include commercial airline navigation, emergency response (fire, ambulance, police), surveying, and tracking fleets of company trucks.

Unfortunately GPS is easily jammed. During a conflict, threat jammers (either airborne or land-based around high value targets) could deprive U.S. forces of the navigational data necessary to prosecute an attack. That's why anti-jamming techniques and technology hold an intense interest for weapon and platform developers.

Jamming and Anti-Jamming

Potential enemy jamming systems and strategies are continuously studied by DOD military analysts. Their findings, coupled with actual threat waveforms and technologies obtained from intelligence sources, provide the raw material for understanding the GPS-jamming threat. The next step in countering the threat is test the threat technology against U.S. GPS systems and then to find ways to thwart the jamming. This is where the GPS Antenna Arena comes into play. The rustic appearance created by the wooden telephone poles is deceptive. This facility is actually a high-technology laboratory capable of duplicating any threat jamming signal and evaluating a test item's response.

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Characterization—*Tests are controlled from the computer at right The equipment at left is used to generate jamming signals and to characterize GPS antenna patterns and anti-jamming-gear performance.*

A Joint Effort

Development of the Arena was funded by the GPS Joint Program Office, which recognized the need for a facility to test GPS jamming and anti-jamming capabilities. NAWCWD proposed the Arena in 1997, and construction began in 1998. Full operation commenced in 1999.

"The challenge of putting this together drew a total base-wide response," explains Boggs. "The 5.0 (test and evaluation) and 4.0 (research and engineering) competencies have truly worked hand-in-hand to build and operate the Arena." Among the contributors to the project were Ron Skatvold and Jennifer Kerns (Advanced Antenna Branch, 474100D), Doug Lamb (Air-to-Air RF Guidance and Controls Branch, 472200D), Butch Burfeindt (Etcheron Valley Range, 522K00D) as well as other staff members of the GPS/INS Branch and the Etcheron Valley Range.

The GPS Antenna Arena is an integral part of a larger NAWCWD GPS/INS team. The Arena shares features with the Navigation Laboratory (NavLab) in the Integrated Battlespace Arena (IBAR), the Salt Wells Antenna Range, the Thompson Lab VHF Chamber, and NAWCWD's set of GPS jammer threat systems (used for test and evaluation). Compatibility among these facilities produces "apples-to-apples" data for quick, accurate analysis and comparison of test results.

Quiet and Secure

The Antenna Arena is located in a remote valley near the northern edge of the Land Range. A more secluded site on DOD land would be hard to find. The valley floor, more than a mile high, is entirely surrounded by mountains. These mountains restrict the GPS-jamming signals so that they do not cause problems for GPS users outside the base boundaries.

Other nearby Etcheron Valley Range facilities include RCS ranges as well as a high-power microwave (HPM) and directed energy weapons (DEW) test facility. The remoteness of the location, coupled with the mountainous terrain, create a unique environment in which sensitive RF signals such as GPS jammer or HPM signals can be radiated at high power levels at any time of the day or night.

Characterization is Key

The entire operation is computer controlled. Operators like Carl Ubil load the scenarios and run the actual test operations. Ubil is an employee of Systems Application and Technologies, Inc. (SA-TECH), a vital part of the Etcheron Valley Range team.

The output of each Antenna Arena test is a comprehensive data package. Using that information, the customer can determine precisely how the GPS test item operates, in both the presence and absence of jamming signals. Once the item has been characterized in the Arena, the customer has a realistic picture of how it will react to threat jammers in a tactical situation.

Boggs sees the business expanding. "We're currently doing testing for the Air Force, and we have a weapon-program-sponsored test coming up soon. We can also work with our commercial partners and allies. GPS jamming is one of the biggest challenges facing our forces, and NAWCWD is in a unique position to meet that challenge."

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